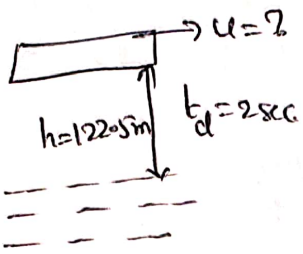
WS-2 9th advanced

Thasks

(1)



$t_d = \frac{u}{g} = \sqrt{\frac{2h}{g}}$

$\Rightarrow \frac{u}{g} = \sqrt{\frac{2\times122.5}{10}}$

$\Rightarrow \frac{u}{g} = \sqrt{25} = 5$

$\Rightarrow u = 5g = 5\times9.8$

$= 49$ m/s (or) 50m/s.

(2) From given data

$u = 100$ m/s

Time of flight $T = \frac{2u}{g}$

$\Rightarrow T = \frac{2\times100}{10}$

$= 20$ sec

(3)

Given $t = 1$ sec.

$t_a = \frac{u}{g} \Rightarrow u = g t_a$

$= g\times1$

$\Rightarrow u = g$

$H = \frac{u^2}{2g} = \frac{g^2}{2g} = \frac{g}{2} = \frac{9.8}{2} = 4.9$ m

(4)

Given height for top from ground $h = 5$m

As the 3rd drop releasing from top, 1st drop touches the ground, means distance travelled by 1st drop is 5m

$\therefore t_d = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2\times5}{10}} = 1$ sec

Time gap between 1st and 3rd drop is 1 sec. so between 1st and 2nd drop it is 0.5 sec.

velocity of 2nd drop after 0.5 sec $v = u + at = 0 + at$

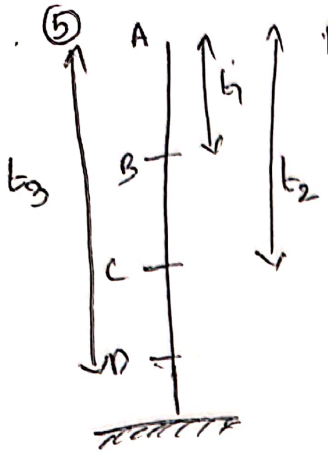
$v = 10\times0.5 = 5$ m/s

From $s = ut + \frac{1}{2}at^2 \Rightarrow h = vt + \frac{1}{2}gt^2$

$= 5\times0.5 + \frac{1}{2}\times10\times(0.5)^2$

$= 3.75$ m

⑤



From A → B

$$t_1 = t_{AB} = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2AB}{g}}$$

A → C

$$t_2 = t_{AC} = \sqrt{\frac{2AC}{g}} = \sqrt{\frac{2(2AB)}{g}} \quad [AC = AB + BC,\ AB = BC]$$

$$\therefore t_2 = \sqrt{2}\sqrt{\frac{2AB}{g}}$$

$h_{AD} = h_{AB} + h_{BC} + h_{CD}$ Given $AB = BC = CD$

$h_{AD} = 3h_{AB} = 3(AB)$

$$t_3 = \sqrt{\frac{2h_{AD}}{g}} = \sqrt{\frac{2(3AB)}{g}} = \sqrt{3}\sqrt{\frac{2AB}{g}}$$

$$t_{C\to D} = t_3 - t_2 = \sqrt{3}\sqrt{\frac{2AB}{g}} - \sqrt{2}\sqrt{\frac{2AB}{g}} = (\sqrt{3}-\sqrt{2})\sqrt{\frac{2AB}{g}}$$

$$t_{B\to C} = t_{AC} - t_{AB} = \sqrt{2}\sqrt{\frac{2AB}{g}} - \sqrt{\frac{2AB}{g}} = (\sqrt{2}-1)\sqrt{\frac{2AB}{g}}$$

$$\therefore t_{AB} : t_{BC} : t_{CD} = \sqrt{\frac{2AB}{g}} : (\sqrt{2}-1)\sqrt{\frac{2AB}{g}} : (\sqrt{3}-\sqrt{2})\sqrt{\frac{2AB}{g}}$$

$$= 1 : (\sqrt{2}-1) : (\sqrt{3}-\sqrt{2})$$

⑥

For $u_1 = u \to H_1 = h$

$u_2 = 2u \to H_2 = ?$

From $H_{max} = \frac{u^2}{2g}$

$H_{max} \propto u^2$

$$\Rightarrow \frac{H_1}{H_2} = \left[\frac{u_1}{u_2}\right]^2$$

$$\Rightarrow \frac{h}{H_2} = \left[\frac{u}{2u}\right]^2 = \frac{1}{2^2} = \frac{1}{4}$$

$$\Rightarrow H_2 = 4h$$

(7)

From given Body

$u=0 \; ; a=g$

For I^{th} sec

From $s=ut+\frac{1}{2}at^2$

$\Rightarrow h=0\times 1+\frac{1}{2}g(1)^2$

$\Rightarrow h=\frac{g}{2}$

For 4^{th} sec ; $x=7h=7\frac{g}{2}$

From $s_n=u+\frac{a}{2}(2n-1)$

$\Rightarrow \frac{7g}{2}=0+\frac{g}{2}(2n-1)$

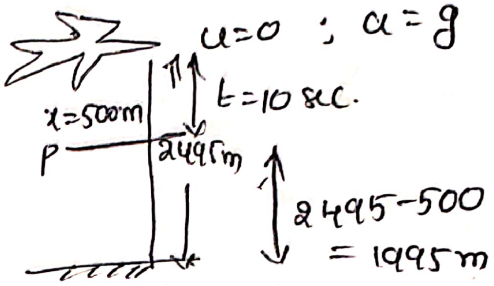
$\Rightarrow 7\frac{g}{2}=\frac{g}{2}(2n-1)$

$\Rightarrow 7=2n-1$

$\Rightarrow 2n=7+1$

$\Rightarrow n=4$

(8)



From $v=u+at$

$\Rightarrow v_p=0+g\times 10 \Rightarrow v_p=10g$

$=100 \text{ m/s}$

From $s=ut+\frac{1}{2}at^2$

$x=0\times t+\frac{1}{2}\times g(10)^2$

$=\frac{1}{2}\times 10\times 100$

$x=500 \text{ m}$

$\therefore y=2495-500=1995 \text{ m}$

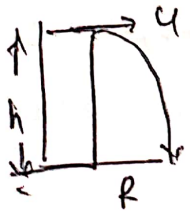
From $v^2-u^2=2as \; [u=v_p]$

$\Rightarrow v^2-(100)^2=2(-2.5)(1995)$

$\Rightarrow v^2-10000=-9975$

$\Rightarrow v^2=25 \Rightarrow v=5 \text{ m/sec.}$

(9)



$R=u\sqrt{\frac{2h}{g}}$

$=v\sqrt{\frac{2h}{g}}$

(10) $u=0 \; ; a=g$

From $s_n=u+\frac{a}{2}(2n-1)$

$s_n=\frac{g}{2}(2n-1)$

For $n=1, 2, 3 \cdots$

$S_1 : S_2 : S_3=\frac{g}{2}(2(1)-1) : \frac{g}{2}(2(2)-1) : \frac{g}{2}(2(3)-1)$

$=(2-1) : (4-1) : (6-1)$

$=1 : 3 : 5$

(11) Given $u = 29.43$ m/s

$$t_a = \frac{u}{g} = \frac{29.43}{9.8}$$

$t_a = 3$ sec

From $s = u + \frac{a}{2}(2n-1)$

$$s = 29.43 + \left(\frac{g}{2}\right)(2(1)-1)$$

$$= 29.43 - \frac{9.8}{2}(2-1)$$

$$= 29.43 - 4.9$$

$$= 24.53 \text{ m}$$

(12) $u = 0$; $a = \frac{g}{8}$; $t = 8$ sec.

$$v_{Balloon} = u + at$$

$$= 0 + \frac{g}{8} \times 8$$

$$v_{Balloon} = g$$

$v_{stone} = v_{Balloon}$

From $s = ut + \frac{1}{2}at^2$

$$s = 0 \times 8 + \frac{1}{2}\frac{g}{8}8^2$$

$$s = \frac{1}{2} g \times 8 = 4g$$

From $h = -ut + \frac{1}{2}gt^2$

$$\Rightarrow 4g = -gt + \frac{1}{2}gt^2$$

$$\Rightarrow 4 = -t + \frac{1}{2}t^2$$

$$\Rightarrow 8 = -2t + t^2$$

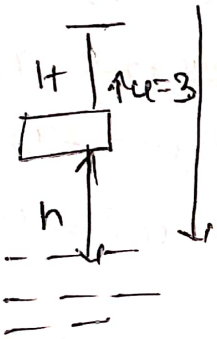
$$\Rightarrow t^2 - 2t - 8 = 0$$

$$\Rightarrow t^2 - 4t + 2t - 8 = 0$$

$$\Rightarrow (t-4)(t+2) = 0$$

$t = 4$ or -2 sec.

(18)



$t = 2$ sec.

From $h = -ut + \frac{1}{2}gt^2$

$$\Rightarrow h = -3(2) + \frac{1}{2}10(2)^2$$

$$= -6 + 20$$

$$= 14 \text{ m}$$

$$H_{max} = \frac{u^2}{2g} = \frac{3^2}{2 \times 10} = \frac{0.9}{2}$$

$$= 0.45 \text{ m}$$

Displacement = F.P − I.P = water − Bridge

$$= 0 - h = 14 \text{ m}.$$

L Task

① $h_{max} = 20\ m$

$t = 4\ sec$

$t_a = \frac{u}{g}$

$\Rightarrow u = t_a \times g$

$= 4 \times 10$

$= 40\ m/s$

② $h_1 = 5\ m \quad ; \quad h_2 = 10.5\ m$

$V_1 = \sqrt{2gh_1} = \quad V_2 = \sqrt{2gh_2}$

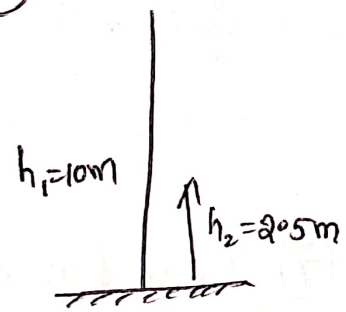
Loss of velocity on bouncing

$$\frac{V_2 - V_1}{V_1} = \frac{\sqrt{2gh_2} - \sqrt{2gh_1}}{\sqrt{2gh_1}}$$

$$= \frac{\sqrt{2g}\left[\sqrt{h_2} - \sqrt{h_1}\right]}{\sqrt{2g}\sqrt{h_1}} = \frac{\sqrt{10.5} - \sqrt{5}}{\sqrt{5}}$$

$$= \frac{1.034 - 2.023}{2.023} = \frac{-2}{5}$$

③



$u_1 = \sqrt{2gh_1} \; ; \; V_2 = \sqrt{2gh_2}$

$t = 0.01 = 10^{-2}\ sec$

$$a = \frac{V_2 - V}{t} = \frac{\sqrt{2gh_2} - \sqrt{2gh_1}}{t}$$

$$= \frac{\sqrt{2g}\left(\sqrt{h_2} - \sqrt{h_1}\right)}{10^{-2}}$$

$$= \frac{\sqrt{2 \times 9.8}\left[\sqrt{10} + \sqrt{2.5}\right]}{10^{-2}}$$

$= 2106\ m/s^2$

④ No of. stairs = 25

$h = nx$

$x \rightarrow$ height of each stair

$u = 0$
$a = g$
$t = 5\ sec$

$t_d = \sqrt{\frac{2h}{g}} =$

$\Rightarrow 5 = \sqrt{\frac{2 \times h}{10}}$

$\Rightarrow 5 = \sqrt{\frac{h}{5}}$

$\Rightarrow h = 125$

$\Rightarrow nx = 125$

$\Rightarrow 25x = 125$

$\Rightarrow x = 5\ m$

(4th continuation)

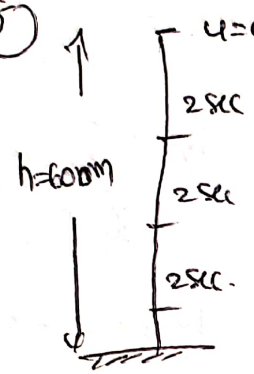
let p be the no. of stairs crossed.

In $t=1$ sec.

$$t=\sqrt{\frac{2Px}{g}} \Rightarrow 1=\sqrt{\frac{2\times P\times 15}{10}}$$

$$\Rightarrow P=1$$

(5)



From $S_n = u + \frac{g}{2}(2n-1)$

$\therefore S_n = \frac{g}{2}(2n-1)$

$S_1 = \frac{g}{2}(2(1)-1) = \frac{g}{2}$

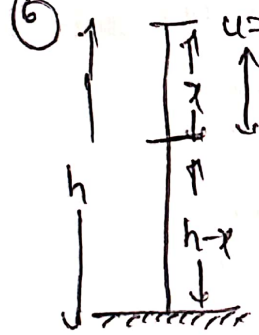
$S_2 = \frac{g}{2}(2(2)-1) = 3\frac{g}{2}$

$S_3 = \frac{g}{2}(2(3)-1) = 5\frac{g}{2}$

$S_1 : S_2 : S_3 = \frac{g}{2} : \frac{3g}{2} : \frac{5g}{2}$

$= 1 : 3 : 5$

(6)



$t_1 \to t \Rightarrow h_1 = h$

$t_2 = \frac{t}{3} \to h_2 = x.$

$h \propto t^2$

$\frac{h_1}{h_2} = \left[\frac{t_1}{t_2}\right]^2$

$\frac{h}{x} = \left(\frac{t}{\frac{t}{3}}\right)^2$

$\Rightarrow \frac{h}{x} = 9$

$\Rightarrow x = \frac{h}{9}$

Position from ground

$= h - x$

$= h - \frac{h}{9}$

$= \frac{8h}{9}$ from ground

(7) Given $v = 10$ m/sec.; $S = \frac{H}{2}$

$H_m = \frac{u^2}{2g} = u^2 = 2gH$

From $v^2 - u^2 = 2as$

$\Rightarrow 10^2 - u^2 = 2(-g)\left(\frac{H}{2}\right)$

$\Rightarrow 100 - 2gH = -gH$

$\Rightarrow 100 = -gH + 2gH$

$\Rightarrow 100 = gH$

$\Rightarrow H = \frac{100}{g} = \frac{100}{10} = 10m$

⑧

Given $m = 100\,gm = 10^{-1}\,kg$

$u = 5\,m/s$

$W = mgH\cos\theta$

$\theta = 180$

$W = 10^{-1} \times 10 \times \frac{u^2}{2g}(-1)$

$= -\frac{5^2}{2\times 10} = -1.25\,J$

⑨

$H = 5m \;;\; T_a = \frac{u}{g}$

$\Rightarrow t_a = \frac{10}{10} = 1\,sec.$

$H_{max} = \frac{u^2}{2g}$

$\Rightarrow 5 = \frac{u^2}{2\times 10} \Rightarrow u^2 = 2\times 10\times 5$

$\Rightarrow u = 10\,m/s$

⑪

$u_1 = u \;;\; u_2 = \frac{u}{3}$

$H_1 = h \;;\; H_2 = x$

$H \propto u^2$

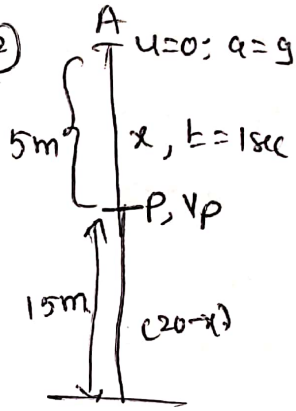
$\Rightarrow \frac{H_1}{H_2} = \left[\frac{u_1}{u_2}\right]^2$

$\Rightarrow \frac{h}{x} = \left[\frac{u}{\frac{u}{3}}\right]^2$

$\Rightarrow \frac{h}{x} = 3^2$

$\Rightarrow x = \frac{h}{9}$

⑫



From $A \to P$

$V_p = u + at$

$= 0 + g(1)$

$V_p = 10\,m/s$

From

$s = ut + \frac{1}{2}at^2$

$x = 0\times 1 + \frac{1}{2}g(1)^2$

$\Rightarrow x = \frac{g}{2} = \frac{10}{2} = 5m$

$t = \frac{s}{V_p} = \frac{15}{10} = 1.5\,sec$

⑰, ⑱, ⑲

Given $u = 50\,m/s$

$n = 6$

From $S_n = u - \frac{g}{2}(2n-1)$

$\Rightarrow S_6 = 50 - \frac{10}{2}(2(6)-1)$

$= 50 - 5(11)$

$= 50 - 55 = -5\,m$

⑱

$S_1 = -5m = S_6$

$\uparrow S_1 = u - \frac{g}{2}(2n-1)$

$= 50 - \frac{10}{2}(2-1)$

$= 50 - 5$

$= 45$

$\frac{S_1\uparrow}{S_1\downarrow} = \frac{45}{5} = \frac{9}{1}$

⑲

$H = \frac{u^2}{2g}$

$= \frac{(50)^2}{2\times 10}$

$H = 125\,m$